LATE SUMMER CHANGES IN MULE DEER DIETS WITH INCREASING USE ON BITTERBRUSH RANGELAND[1]

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Abstract.— Late summer diet composition of mule deer was determined daily within a mountain browse enclosure dominated by antelope bitterbrush. Palatable forages of low abundance were rapidly depleted, and bitterbrush continually composed over 50% of the diet, even at utilization exceeding 350 deer-days/ha. The relationship of bitterbrush forage production and deer-days use is discussed.

Documentation clearly shows that rangelands containing antelope bitterbrush (*Purshia tridentata*) are important to mule deer (*Odocoileus hemionus*) in winter (Kufeld et al. 1973). Furthermore, on low elevation ranges where succulent forages are scarce, bitterbrush has been reported a major and palatable contribution to summer diets (Leach 1956, Lesperance et al. 1970, Trout and Thiessen 1973, Tueller and Monroe 1976, Tueller 1979, Austin and Urness 1983). Although these summer studies have shown the importance of bitterbrush, they have provided only limited information on changes in diet as preferred forages are depleted. This paper reports progressive dietary changes in a short-duration, high-intensity grazing trial (totaling 356 deer-days/ha; 144 dd/ac) and develops a guideline for estimating potential summer deer-days use on comparable rangeland sites.

Methods

An enclosure containing .07 ha (.17 ac) was constructed on the West Tintic Mountains at 1970 m (6460 ft) elevation in Tooele County, Utah. Three tame, adult female mule deer were used to determine diets. Although studies concerned primarily with comparing wild and tame deer are unavailable, the assumption that tame deer are behaviorally comparable to wild deer is supported by secondary findings of several researchers (Healy 1971, Willms and McLean 1978, Holl et al. 1979, Bartmann 1982, Austin et al. 1983). Deer were allowed to graze freely within the enclosure, and forage selection (bites by species) was recorded each morning and evening for about three hours during a consecutive eight-day trial in late August 1982. During grazing periods each deer was observed alternately for 20 minutes. Data were initially summarized by individual days. Because of diet similarities between some days and evident differences between others, however, the data were collapsed into four unequal periods. Diets were determined as percent dry weight consumption by species using hand-plucked simulated bites (Deschamp et al. 1979).

Vegetal production, and forage availability after grazing, within the enclosure were determined by sampling immediately before and after the grazing trial from 25 evenly spaced 1 m^2 (10 ft^2) circular plots established on a predetermined grid. Half of each plot was clipped before (south half) and after (north half) grazing. Forage utilization of plant species by deer was determined as the difference between pre- and postgrazing clippings. Weight by species was measured to the nearest gram and converted to dry weight from oven-dried samples.

Palatable plant species were defined as having the initial ratio of percent diet contribution divided by percent vegetal production greater than 1.0, and the ratio for unpalatable species was less than 1.0 (Neff 1974). Because palatability for individual species varies with season and vegetal community, palatabilities indicated below cannot be ap-

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plied to other areas of differing habitat (Welch et al. 1981).

RESULTS

Vegetal production within the enclosure (Table 1) was dominated by browse (61%), with the remainder a mixture of grasses (19%), primarily bluebunch wheatgrass (*Agropyron spicatum*), forbs (11%), and cacti (9%). Total production was almost 900 kg/ha (800 lbs/ac). Bitterbrush composed 31% of the total browse, and unpalatable browse species contributed 67%.

During the 8-day trial, with each day equal to a grazing pressure of about 45 deer-days/ha (18 dd/ac), a total of 22,865 bites was recorded. The first period, 0–45 deer-days/ha (0–18 dd/ac), showed high dietary contribution of palatable species of low abundance, including Utah serviceberry (*Amelanchier utahensis*), mountain snowberry (*Symphoricarpos oreophilus*), common bastard toadflax (*Commandra umbellata*), and wayside gromwell (*Lithospermum ruderale*). These species composed 36% of the diet in the first period, but contributed less than 4% for subsequent periods (Table 1).

During period 2, 46–178 deer-days/ha (19–72 dd/ac), bitterbrush composed most of the diet as other palatable species became increasingly scarce (Table 1). Although unpalatable browse and grass were mostly ignored, most forbs were taken when found.

Period 3, 179–267 deer-days/ha (73–108 dd/ac), showed a slow shift toward the use of unpalatable forages as bitterbrush forage became less abundant and its proportion in the diet declined. This trend continued through period 4, with unpalatable browse and grass increasing in dietary contribution.

At the end of the trial, utilization of palatable shrubs exceeded 90%, and use of both cured and green forbs averaged about 80%. Use of unpalatable shrubs was much lower, with no use of pricklypear (*Opuntia* spp.). The figure of 48% utilization for mountain big sagebrush (*Artemisia tridentata vaseyana*) was probably somewhat inflated, as evidenced by its low dietary contribution (Table 1), and probably resulted from sampling insufficient plots for its uneven spacing. Since grass use (29%) included the effects of trampling, the actual percentage of forage used would likely be considerably less (Austin et al. 1983).

DISCUSSION

It is evident from our data that considerable deer-days use can be supplied in sum-

TABLE 1. Vegetal production (kg/ha), deer diet composition (%) within grazing periods (± standard error), and forage utilization (%) in a bitterbrush rangeland exclosure.

Vegetal class	Species	Production	Grazing periods (deer-days/ha) 0–45	46–178	179–267	268–356	Forage utilization
Palatable shrubs	*Purshia tridentata*	172.3	51.8 ± 16.9	82.3 ± 1.4	74.7 ± 6.8	69.1 ± 9.9	93
	Amelanchier utahensis	5.6	9.3 ± 9.2	0.8	0.3	1.2 ± 1.2	93
	Symphoricarpos oreophilus	3.9	8.2 ± 4.9	0.6	0.3	0.3	90
Unpalatable shrubs	*Chrysothamnus viscidiflorus*	96.3	0.0	0.2	5.6 ± 3.9	10.9 ± 7.0	44
	Artemisia tridentata	69.8	0.0	0.2	3.2 ± 0.4	1.8 ± 1.8	48
	Juniperus osteosperma	200.4	0.7	2.2 ± 1.4	1.0 ± 0.6	2.5 ± 2.7	7
Cured forbs	*Crepis accuminata*	20.1	4.6 ± 1.5	2.1 ± 1.0	2.5 ± 0.7	2.4 ± 0.8	82
	Lupinus caudatus	3.0	0.6	3.3 ± 1.8	1.8 ± 1.3	2.0 ± 1.6	75
	Balsamorhiza hispida	8.6	0.5	0.7	2.4 ± 1.5	1.5 ± 1.1	74
	9 others	27.6	3.4 ± 1.5	3.4 ± 2.3	2.1 ± 0.7	1.9 ± 0.8	62
Green forbs	*Commandra umbellata*	18.9	9.9 ± 5.9	3.0 ± 1.6	1.7 ± 0.9	0.9	85
	Lithospermum ruderale	13.6	8.9 ± 9.4	0.4	0.0	0.0	85
	5 others	11.4	2.0 ± 2.1	0.5	0.4	0.1	93
Cacti	*Opuntia* spp.	76.8	0.0	0.0	0.0	0.0	0
Grasses	Gramineae	169.0	0.1	0.3	4.0 ± 2.9	5.4 ± 3.5	29
Total		897.3					

mer by bitterbrush rangelands. In addition to the deer use, grazing by livestock to utilize the grass resource and maintain the bitterbrush stand should be applied in spring when grass is succulent (Smith and Doell 1968, Jensen et al. 1972, Austin and Urness 1983).

Since bitterbrush comprises a high proportion of the summer diet where other palatable forages are scarce, a direct relationship between potential deer use and bitterbrush production seems reasonable. Austin and Urness (1983) reported that 122 deer-days/ha (49 dd/ac) use was reasonable for a similar area where bitterbrush production was 130 kg/ha (116 lbs/ac). In their analyses it was assumed that daily dry weight intake of bitterbrush averaged 1.5 kg/deer-day and utilization of current annual growth was 70%. In this study, 172 kg/ha (153 lbs..c) of bitterbrush forage was available and 178 deer-days/ha (72 dd/ac) use accrued before diets began changing due to depletion of bitterbrush. From these data, we suggest that dry weight production (kg/ha) of bitterbrush be numerically equated to summer deer-days/ha use as a first approximation. In our study area where winter use by deer is small, reserving bitterbrush forage is unnecessary; however, adjustments may be needed on areas where winter use is significant.

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